研究課題名 : High resolution transport modeling for greenhouse gas emission studies with GOSAT data
(GOSAT データを利用した温室効果ガス放出推定のための大気輸送モデルの高解像度化)

課題代表者：国立環境研究所地球環境研究センター　Shamil Maksyutov
共同研究者：国立環境研究所地球環境研究センター　白井知子・中山忠暢・齊藤 誠・金 憲淑・Rajesh Janardanan・石澤みさ・馬淵和雄
国立極地研究所　北極観測センター　Dmitry Belikov
Indian Institute of Tropical Meteorology (India)　Vinu Valsala
Universities Space Research Association (US)　小田知宏
国際基督教大学教養学部　峰島知芳
Central Aerological Observatory (Russia)　Alexander Ganshin

実施年度：平成 28 年度～平成 30 年度

1. Objective

Developing high resolution transport modeling algorithm for GOSAT XCO_2 and XCH_4 data analysis, increasing resolution of the tracer transport model. High resolution transport is needed for analysis of the anthropogenic emissions from megacities, power plants and forest fire.

2. Research plan

This study aims at generation and application of global high resolution meteorological fields simulated by the Non-hydrostatic Icosahedral Atmospheric Model (NICAM) to make simulation resolving high frequency variability of CO_2 concentrations using Lagrangian particle dispersion model FLEXPART and high resolution CO_2 and CH_4 flux fields (1 km and 10 km). The surface CO_2 flux datasets include the three major individual components of terrestrial, oceanic and fossil fuel fluxes. The background concentrations of CO_2 are provided by an off-line global atmospheric tracer transport model (NIES-TM). High resolution meteorological fields are generated by NICAM at 28 km spatial resolution using nudging to JRA-55 data.

3. Research progress

We have used JRA-55 meteorological fields in nudged simulation of high resolution NICAM at horizontal resolution 28km with 45 vertical layers, and 2 min time step. In this modeling setup we use an Eulerian Tracer Transport model NIES-TM and Lagrangian Particle dispersion model FLEXPART. We have prepared a setup for 28 km nudged simulations of NICAM and analysis meteorology conversion scripts.

For Flexpart forward simulations, fossil fuel CO_2 emission fields are derived from Open source Data Inventory of Anthropogenic CO_2 emission (ODIAC), (1×1km). The biospheric fluxes climatology at 0.1 degree resolution was made using VISIT model. Simulation of transport using highly resolved (spatial and temporal) flux fields is improved by the use of comparably resolved atmospheric flow fields. NICAM simulation setup was run on SX-Ace to produce 3 month test data. The interpolation program for converting the NICAM data to hybrid pressure vertical coordinates was developed and tested and the Flexpart model setup was prepared for using the NICAM generated wind fields with high temporal (1 hour) and spatial (28 km) resolution.

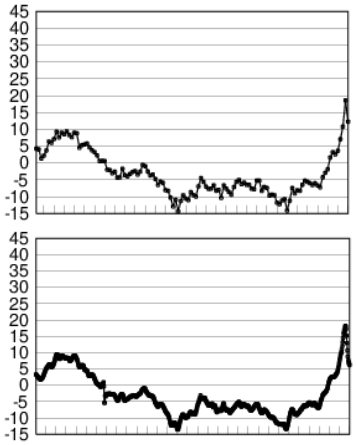

Fig. 1. Comparison of the wind speed in Sep 2009 at 10 m height simulated by JRA55 (top) and NICAM (bottom).

4. Planned development.

The NICAM-generated wind data will be produced for time period of 2009-2010 and will be used for simulating XCO_2 with Flexpart model.

5. 昨年度終了研究課題名

GOSAT による濃度データの高精度モデル予測と温室効果ガスの地表面吸収排出量の推定
(High-resolution transport modeling for GOSAT retrieval and inverse modeling of surface greenhouse gas fluxes)

6. 計算機資源の利用状況（2015 年 10 月 1 日～2016 年 10 月 31 日）

Number of users: 13
CPU hours v_deb: 19.81 hours, v_32cpu: 6.93 hours, v_96cpu: 3,921.80 hours, v_160cpu: 15,334.92 hours, 計: 19,283.47 hours